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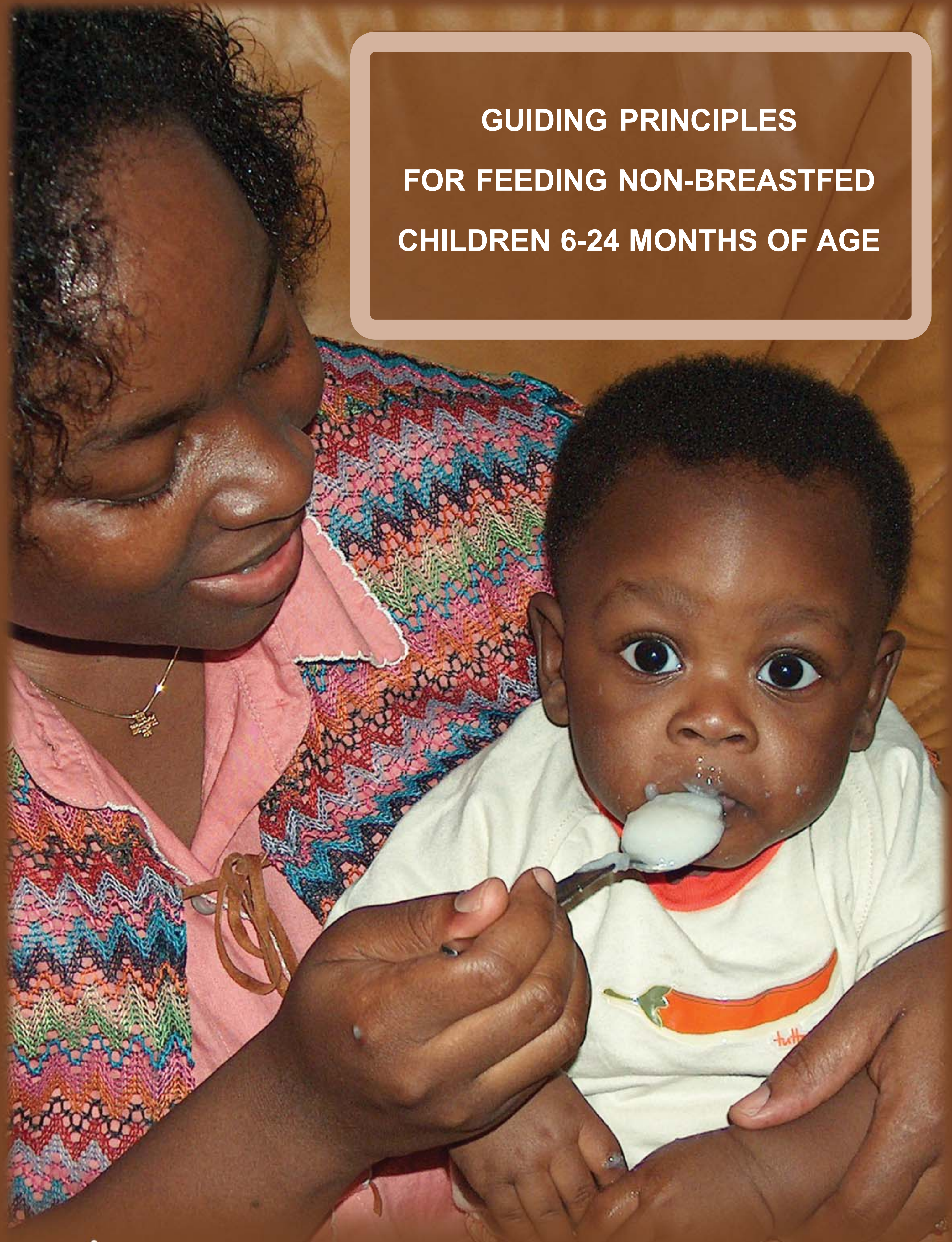
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GUIDING PRINCIPLES FOR FEEDING NON-BREASTFED CHILDREN 6-24 MONTHS OF AGE



World Health Organization

PHOTOS

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GUIDING PRINCIPLES FOR FEEDING NON-BREASTFED CHILDREN 6-24 MONTHS OF AGE

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TABLES

ANNEXES

INTRODUCTION

Adequate nutrition during infancy and early childhood is fundamental to the development of each child's full human potential. It is well recognized that the period from birth to two years of age is a "critical window" for the promotion of optimal growth, health and behavioural development. Longitudinal studies have consistently shown that this is the peak age for growth faltering, deficiencies of certain micronutrients, and common childhood illnesses such as diarrhoea. After a child reaches two years of age, it is very difficult to reverse stunting that has occurred earlier (Martorell et al., 1994). The immediate consequences of poor nutrition during these formative years include significant morbidity and mortality and delayed mental and motor development. In the long term, early nutritional deficits are linked to impairments in intellectual performance, work capacity, reproductive outcomes and overall health during adolescence and adulthood. Thus, the cycle of malnutrition continues, as the malnourished girl child faces greater odds of giving birth to a malnourished, low-birth-weight infant when she grows up. Poor infant feeding practices, coupled with high rates of infectious diseases, are the principal proximate causes of malnutrition during the first two years of life. For this reason, it is essential to ensure that caregivers are provided with appropriate guidance regarding optimal feeding of infants and young children.

Not all children will be able to enjoy the multiple benefits of breastfeeding.

According to current UN recommendations, infants should be exclusively breastfed for the first six months of life, and thereafter should receive appropriate complementary feeding with continued breastfeeding up to two years or beyond. However, there are a number of infants who will not be able to enjoy the benefits of breastfeeding in the early months of life or for whom breastfeeding will stop before the recommended duration of two years or beyond. A group that calls for particular attention is the infants of mothers who are known to be HIV-positive. To reduce the risk of transmission, it is recommended that when replacement feeding is acceptable, feasible, affordable, sustainable and safe, mothers should avoid breastfeeding from birth. Otherwise, they should breastfeed exclusively and make the transition to exclusive replacement feeding as soon as alternative feeding options become feasible. Other circumstances that may prevent a child from being breastfed include death or severe illness in the mother, or inability or lack of desire by the mother to breastfeed. Guidelines regarding replacement feeding from birth to six months for infants of HIV-positive

mothers are published elsewhere (WHO/UNICEF/UNFPA/UNAIDS, 2003). The present document presents guidelines for feeding non-breastfed children after the first six months of life. These Guiding Principles are intended to guide policy and programmatic action at global, national, and community levels.

PAHO's publication *Guiding Principles for Complementary Feeding of the Breastfed Child* (2003) provides guidance on appropriate feeding of breastfed infants from six months onwards. Some of these guiding principles are applicable to non-breastfed children, but others are not, or require adaptation. To identify an analogous set of guiding principles for feeding non-breastfed children from 6-24 months of age, an informal meeting organized by WHO's Departments of Child and Adolescent Health and Development and Nutrition for Health and Development was held 8-10 March 2004 in Geneva. The guiding principles herein were developed based on the evidence presented in the background document for the meeting (Dewey et al., 2004) and consensus of participants in the meeting (Informal Working Group on Feeding Non-breastfed Children, 2004). They apply to normal, term infants (including low-birth-weight infants born at > 37 weeks gestation). Infants or children recovering from acute malnutrition or serious illnesses may need specialized feeding, which is covered by clinical manuals (for example, the WHO manual "Management of the Child with a Serious Infection or Severe Malnutrition", 2000). Pre-term infants may also need special feeding. The guidelines in this document can be used as the basis for developing recommendations for those subgroups.



one

AMOUNT OF FOOD NEEDED

A. Guideline: Ensure that energy needs are met. These needs are approximately 600 kcal per day at 6-8 months of age, 700 kcal per day at 9-11 months of age, and 900 kcal per day at 12-23 months of age.

B. Scientific rationale: The total energy requirements of healthy breastfed infants are 615 kcal/d at 6-8 months, 686 kcal/d at 9-11 months, and 894 kcal/d at 12-23 months of age (Dewey and Brown, 2003). The values are slightly higher when based on a combined group of breastfed and formula-fed infants (634, 701 and 900 kcal/d at 6-8, 9-11 and 12-23 months, respectively; Butte et al., 2000), because resting metabolic rate is higher in formula-fed infants. However, because these guiding principles are targeted primarily at populations in which use of commercial infant formulas after six months of age would be uncommon, the energy requirements of breastfed infants have been used as the reference.

In practice, caregivers will not be measuring the energy content of foods to be offered. Thus, the amount of food to be offered should be based on the principles of responsive feeding (guideline #8), while assuring that energy density and meal frequency are adequate to meet the child's needs (see # 3, below). Table 1 shows examples of sample diets and the approximate quantities of local foods that would meet the energy needs described above. It is important not to be overly prescriptive about such guidance, however, recognizing that each child's needs will vary due to differences in body size and growth rate.

Children recovering from illness or living in environments where energy expenditure is high may require more energy than the average quantities listed here.

FOOD CONSISTENCY

A. Guideline: Gradually increase food consistency and variety as the infant gets older, adapting to the infant's requirements and abilities. Infants can eat pureed, mashed and semi-solid foods beginning at six months. By eight months most infants can also eat "finger foods" (snacks that can be eaten by children alone). By 12 months, most children can eat the same types of foods as consumed by the rest of the family (keeping in mind the need for nutrient-dense foods, as explained in #4 below). Avoid foods in a form that may cause choking (i.e., items that have a shape and/or consistency that may cause them to become lodged in the trachea, such as whole nuts, whole grapes or raw carrots, whole or in pieces).

B. Scientific rationale: The neuromuscular development of infants dictates the minimum age at which they can ingest particular types of foods (WHO/UNICEF, 1998). Semi-solid or pureed foods are needed at first, until the ability for "munching" (up and down mandibular movements) or chewing (use of teeth) appears. The ages listed above represent the usual capabilities of normal, healthy infants. When foods of inappropriate consistency are offered, the child may be unable to consume more than a trivial amount, or may take so long to eat that food intake is compromised. Evidence from several sources (Dewey and Brown, 2003) indicates that by 12 months, most infants are able to consume "family foods" of a solid consistency, although many are still offered semi-solid foods (presumably because they can ingest them more efficiently, and thus less time for feeding is required of the caregiver). There is suggestive evidence of a "critical window" for introducing "lumpy" solid foods: if these are delayed beyond ten months of age, it may increase the risk of feeding difficulties later on (Northstone et al., 2001). Thus, although it may save time to continue feeding semi-solid foods, for optimal child development it is advisable to gradually increase food consistency with age.

Food consistency and variety should be increased with the child's age. By 12 months, most children can eat family foods.

two

MEAL FREQUENCY AND ENERGY DENSITY

A. Guideline: For the average healthy infant, meals should be provided 4-5 times per day, with additional nutritious snacks (such as pieces of fruit or bread or chapatti with nut paste) offered 1-2 times per day, as desired. The appropriate number of feedings depends on the energy density of the local foods and the usual amounts consumed at each feeding. If energy density or amount of food per meal is low, more frequent meals may be required.

B. Scientific rationale: The above guideline is based on theoretical estimates of the number of feedings required, calculated from energy requirements (see #1 above), and assuming a gastric capacity of 30 g/kg body weight/day and a minimum energy density of foods of 0.8 kcal/g (Dewey and Brown, 2003). Meals include milk-only feeds, other foods, and combinations of milk feeds and other foods. Snacks are defined as foods eaten between meals - usually self-fed, convenient and easy to prepare. Table 2 shows the minimum number of meals required with three different estimates of energy density (0.6, 0.8 or 1.0 kcal/g). At the lowest energy density (0.6 kcal/g), 5-6 meals/day would be needed. This decreases to ~ 4 meals/day when energy density is at least 0.8 kcal/g, and to ~3 meals/day when energy density is at least 1.0 kcal/g. If a child typically consumes amounts that are less than the assumed gastric capacity at each meal, meal frequency would need to be higher than the values in Table 2.

Conversely, the minimum dietary energy density required depends on meal frequency. Table 2 shows that the minimum energy density is ~0.65 kcal/g when there are five meals per day, ~0.75 kcal/g when there are four meals per day, and ~1.0 kcal/g when there are three meals per day.

three

Meals, including milk-only feeds, other foods, and combinations of milk feeds and other foods, should be provided four or five times per day.

These estimates provide a margin of safety because 2 SD has been added to the average energy requirement in order to meet the needs of nearly all children. Thus, not all children will need the number of meals shown in Table 2. As it is not possible to know which children have higher or lower energy requirements, caregivers should be attentive to the child's hunger cues when judging how often and how much to feed the child.



NUTRIENT CONTENT OF FOODS

A. Guideline: Feed a variety of foods to ensure that nutrient needs are met.

- Meat, poultry, fish or eggs should be eaten daily, or as often as possible, because they are rich sources of many key nutrients such as iron and zinc. Milk products are rich sources of calcium and several other nutrients. Diets that do not contain animal-source foods (meat, poultry, fish or eggs, plus milk products) cannot meet all nutrient needs at this age unless fortified products or nutrient supplements are used.

- If adequate amounts of other animal-source foods are consumed regularly, the amount of milk needed is ~200-400 mL/d; otherwise, the amount of milk needed is ~300-500 mL/d. Acceptable milk sources include full-cream animal milk (cow, goat, buffalo, sheep, camel), Ultra High Temperature (UHT) milk, reconstituted evaporated (but not condensed) milk, fermented milk or yogurt, and expressed breast milk (heat-treated if the mother is HIV-positive).

- If milk and other animal-source foods are not eaten in adequate amounts, both grains and legumes should be consumed daily, if possible within the same meal, to ensure adequate protein quality.

- Dairy products are the richest sources of calcium. If dairy products are not consumed in adequate amounts, other foods that contain relatively large amounts of calcium, such as small fish that include the bones (dried or fresh, with the bones crushed or otherwise processed so that they are safe to eat) and lime-treated maize tortillas, can fill the gap. Other foods such as soybeans, cabbage, carrots, squash, papaya, dark green leafy vegetables, guava and pumpkin are useful additional sources of calcium.

- The daily diet should include Vitamin A-rich foods (e.g. dark coloured fruits and vegetables; red palm oil; vitamin A-fortified oil or foods); vitamin C-rich foods (e.g. many fruits, vegetables and potatoes) consumed with meals to enhance iron absorption; and foods rich in the B vitamins including riboflavin (e.g. liver, egg, dairy products, green leafy vegetables, soybeans), vitamin B6 (e.g. meat, poultry, fish, banana, green leafy vegetables, potato and other tubers, peanuts) and folate (e.g. legumes, green leafy vegetables, orange juice).

- Provide diets with adequate fat content. If animal source foods are not consumed regularly, 10-20 g of added fats or oils are needed unless a fat-rich food is given (such as foods or pastes made from groundnuts, other nuts and seeds). If animal-source foods are consumed, up to 5 g of additional fats or oils may be needed.

- Avoid giving drinks with low nutrient value, such as tea, coffee and sugary soft drinks. Limit the amount of juice offered, to avoid displacing more nutrient-rich foods.

B. Scientific rationale:

1) *Protein and micronutrient content.* Because of the rapid rate of growth and metabolic rate during the first two years of life, nutrient needs per unit body weight of infants and young children are very high. Given the relatively small amounts of foods that are consumed at 6-24 months, the nutrient density (amount of each nutrient per 100 kcal of food) of the diet needs to be very high. To evaluate the potential for various diets to meet nutrient needs at this age, linear programming techniques were applied to data available from five developing countries, three in Latin America (Peru, Honduras and Guatemala), one in Africa (Ghana), and one in Asia (Bangladesh) (Dewey et al., 2004). The results indicated that a diet based predominantly on unfortified plant-based foods cannot meet the needs for certain micronutrients at this age, particularly iron, zinc, calcium and vitamin B12. Therefore, it is advisable to include milk products, as well as meat, poultry, fish or eggs, as often as possible.

   Milk products are important sources of several key nutrients, such as protein, calcium and riboflavin. There has been concern about feeding animal milk such as unmodified cow's milk to infants under 12 months of age because it has a relatively low iron content, may provoke occult gastrointestinal blood loss, and has a high potential renal solute load. However, recent studies on occult blood loss suggest that in the older infant the losses are very minor and not likely to affect iron status (Fuchs et al., 1993; Ziegler et al., 1999). The gastrointestinal response to cow's milk that causes blood loss decreases with age and disappears by 12 months (Ziegler et al., 1999). Furthermore, heat-treated cow's milk does not provoke blood loss (Fomon et al., 1981), so use of boiled or evaporated milk would eliminate this risk. Thus, the risk of iron deficiency provoked by occult blood loss appears to be low and can be further reduced by heat treatment or restrictions on the amount of milk consumed. Although the low iron content and bioavailability of cow's milk can contribute to anemia, iron deficiency can be avoided by using iron supplements or fortified foods with adequate bioavailability.



   The remaining issue is the potential renal solute load of animal milk, which is high due to the relatively large amount of protein and several minerals (sodium, chloride, potassium and phosphorus). Potential renal solute load refers to the solutes coming from the diet that must be excreted by the kidney if none was used for growth and none was lost through non-renal routes (Fomon, 1993). A high potential renal solute load can lead to hypernatremic dehydration under conditions of water stress. During the first six months of life, when infants usually receive nearly all of their nutrients from a single source (breast milk or formula), it is important to ensure that the potential renal solute

load of that product is appropriate. However, when infants begin to consume a mixed diet, the risks of providing a product with a relatively high potential renal solute load, such as undiluted cow's milk, can be avoided if a sufficient amount of fluid is included in the overall diet (see #6 below). The greatest danger occurs when the child has diarrhoea and is losing far more water than usual. Continued use of foods with a high potential renal solute load during diarrhoea, without providing extra fluids, can exacerbate the situation. Thus, if animal milk is a significant part of the diet, special attention needs to be paid to ensuring adequate hydration during illness.

The amount of milk needed to meet nutrient requirements depends on the other foods consumed by the child. When the diet does not include fortified foods or supplements, the linear programming analyses indicated that the amounts of milk needed range from ~200-400 mL/d if other animal-source foods are included in the diet, and ~300-500 mL/d if not (Dewey et al., 2004). Raw milk (i.e. not boiled or pasteurized) should be avoided because of the risk of disease transmission. Fermented milk products (e.g. yogurt) hold promise for reducing the risk of illness due to contamination, as they are more resistant to bacterial growth and can more easily be fed by spoon, when compared with non-fermented liquid milk. Fermentation may also enhance the absorption of minerals, and the probiotic properties of fermented milks may have beneficial effects on the microflora of the gastrointestinal tract. Commercial infant formula is an option when it is available, affordable, can be safely used, and provides a nutritional or other advantage over animal milk (e.g. if fortified food products or supplements are not available or are more expensive). In these circumstances, the amounts of prepared formula needed at 6-12 months of age are ~280-500 mL/d if other animal-source foods are included in the diet, and ~400-550 mL/d if not.



Full-cream milk is an important source of fat during the first two years of life. Skimmed (non-fat) milk is not recommended as a major food source for children under two because it does not contain essential fatty acids, is deficient in fat-soluble vitamins and has a high potential renal solute load in relation to energy. Semi-skimmed milk may be acceptable after 12 months of age. Condensed milk has added sugar and a very high osmolarity and thus is not suitable as an infant food. Milk "substitutes" (e.g. coffee creamer, soy milk) are not nutritionally equivalent to animal milk and are not recommended as a major food source, although soy-based infant formulas are acceptable.

To meet the need for nutrients such as iron and zinc, animal-source foods other than milk products are also needed unless multiple micronutrient supplements or adequate amounts of fortified products are provided. The amounts included in the linear programming analyses were 50 g egg (1 egg/d) and 14-75 g/d of meat, poultry, fish or liver. However, in many populations, infants do not typically consume these amounts

of animal source foods every day, and even if they did the diet would usually still fall short of the amount of iron required. Thus, in most cases some sort of nutrient supplement or fortified food will be necessary (see #5, below).

Animal source foods are also a good source of high quality protein. Although protein deficiency is less common during infancy than was once thought to be the case, it remains a concern in populations with excessive reliance on a single staple plant food with a low protein content, such as cassava. Also, many plant foods have an "unbalanced" essential amino acid composition. Grains are generally low in lysine whereas legumes tend to be low in the sulfur-containing amino acids. By combining grains and legumes, an adequate protein quality can be obtained. Thus, when animal-source foods are not consumed in sufficient amounts, both grains and legumes should be included in the daily diet, preferably within the same meal.

Potential allergic reactions related to consumption of certain high-protein foods during infancy have been a concern in some industrialized countries (food allergies appear to be less common in developing countries). For example, the American Academy of Pediatrics recommends that infants with a strong family history of allergy should not receive cow's milk until one year of age, eggs until two years, and peanuts, nuts, fish and shellfish until three years of age (AAP, 2004). It is thought that avoidance of foods with documented allergenic potential may delay or prevent some food allergy and atopic dermatitis in high-risk infants. However, controlled studies demonstrating that restrictive diets after six months of age have an allergy-preventing effect have not been published (Halken and Host, 2001), and for this reason no such restrictions were advised by an international group of experts (WHO/IAACI, 2000).

Diets that are low in dairy products will generally not provide sufficient calcium. Under these circumstances, other foods that have a reasonable amount of calcium, such as fish products that include the bones or lime-treated maize tortillas, can help fill the gap, though fortified products may still be needed. Green leafy vegetables contain a large amount of calcium, but in those that are also high in oxalates (such as spinach), the bioavailability of calcium is poor. Other plant foods that are relatively high in calcium (i.e., the estimated amount of calcium absorbed is > 15 mg per 100 kcal of food consumed) include soybeans, cabbage, carrots, squash, papaya, guava and pumpkin.

The advice to provide vitamin A-rich foods daily is based on the clear health benefits associated with preventing vitamin A deficiency (Allen and Gillespie, 2001). Vitamin C-rich foods are important not only as a source of vitamin C itself, but to enhance non-heme iron absorption. The B vitamins are essential for child growth and development, and those listed (riboflavin, vitamin B6 and folate) are often limiting in the diets of young children in developing countries (Dewey and Brown, 2003).

2) *Fat content*. Fat is important in the diets of infants and young children because it provides essential fatty acids, facilitates absorption of fat-soluble vitamins, and enhances dietary energy density and sensory qualities. Although there is debate about the optimal amount of fat in the diets of infants and young children, the range of 30-45% of total energy has been suggested (Dewey and Brown, 2003; Bier et al., 1999) as a reasonable compromise between the risks of too little intake (such as inadequate essential fatty acids and low energy density) and excessive intake (thought to potentially increase the likelihood of childhood obesity and future cardiovascular disease, although the evidence on this point is limited [Milner and Allison, 1999]). In the linear programming analyses (Dewey et al., 2004), the diets were designed to provide at least 30% of energy as fat. When animal-source foods that contain some fat are consumed regularly (such as whole cow's milk), only a small amount of additional fat (up to 5 g/d), if any, is needed. However, if animal-source foods are not consumed regularly, 10-20 g of additional fats or oils are needed unless fat-rich plant foods are consumed, such as avocado or pastes made from groundnuts, other nuts or seeds.

   When developing dietary guidelines to provide adequate fat, it is important to take into account the potential effect of added fat (such as oil mixed with porridge) on the overall nutrient density of the diet. For example, the addition of one teaspoon of vegetable oil to 100 g of a typical maize pap used in West Africa would increase the energy density from 0.28 to 0.73 kcal/g, but would reduce the proportion of energy derived from protein from 8.9% to 3.3%, and iron density from 0.5 to 0.2 mg/100 kcal (WHO/UNICEF, 1998). These effects could exacerbate micronutrient malnutrition in vulnerable populations unless other measures (such as fortification or supplementation) are taken to ensure adequate micronutrient intake.

Diets that do not contain animal-source foods cannot meet all nutrient needs unless fortified products or nutrient supplements are be used.

3) *Beverages with low nutrient value*. Tea and coffee contain compounds that can interfere with iron absorption (Allen and Ahluwalia, 1997), and thus are not recommended for young children. Sugary drinks, such as soft drinks, should be avoided because they contribute little other than energy, and thereby decrease the child's appetite for more nutritious foods. Excessive juice consumption can also decrease the child's appetite for other foods, and may cause loose stools. For this reason, the American Academy of Pediatrics (2004) recommends no more than 180 ml of fruit juice per day. Studies in the United States of America have linked excess fruit juice consumption to failure to thrive (Smith and Lifshitz, 1994) and to short stature and obesity (Dennison et al., 1997), although such outcomes have not been consistently observed (Skinner et al., 1999).



five

USE OF VITAMIN-MINERAL SUPPLEMENTS OR FORTIFIED PRODUCTS

A. Guideline: As needed, use fortified foods or vitamin-mineral supplements (preferably mixed with or fed with food) that contain iron (8-10 mg/d at 6-12 months, 5-7 mg/d at 12-24 months). If adequate amounts of animal-source foods are not consumed, these fortified foods or supplements should also contain other micronutrients, particularly zinc, calcium and vitamin B12. In countries where vitamin A deficiency is prevalent or where the under-five mortality rate is over 50 per 1000, it is recommended that children 6-24 months old receive a high-dose vitamin A supplement (100,000 IU once for infants 6-12 months old and 200,000 IU bi-annually for young children 12-23 months old).

B. Scientific rationale: Diets that are predominantly plant-based generally provide insufficient amounts of certain key nutrients (particularly iron, zinc and calcium) to meet the recommended nutrient intakes during the age range of 6-24 months (WHO/UNICEF, 1998; Gibson et al., 1998; Dewey and Brown, 2003). Inclusion of animal-source foods can meet the gap in some cases, but this increases the cost and thus may not be practical for the lowest income groups. Furthermore, the amounts of animal-source foods that can feasibly be consumed by infants (e.g., at 6-12 months) are generally insufficient to meet the gap in iron (Dewey et al., 2004). The difficulty in meeting the needs for these nutrients during infancy is not unique to developing countries. Average iron intakes of infants in industrialized countries would fall well short of the recommended intake if iron-fortified products were not widely available (WHO/UNICEF, 1998).

> Key micronutrients (iron, zinc, calcium, vitamin B12) will need to be given if diets are plant-based.

In industrialized countries, iron-fortified foods for infants have been widely consumed for decades, and some manufacturers have added zinc as a fortificant in recent years. Such products are not as widely available in developing countries (except through social programmes that usually reach only a small proportion of the population), although there is increasing attention to this strategy for ensuring adequate infant nutrition (Lutter, 2000; Lutter 2003). An alternative to commercial fortification of processed foods is the strategy of "home-fortification", i.e. mixing products that contain concentrated amounts of vitamins and minerals (e.g. "sprinkles", crushable tablets, or fat-based spreads; Dewey and Brown, 2003;

Nestel et al., 2003) directly with the foods prepared for the infant in the home. The advantages of this approach are that it allows for providing the dose needed regardless of the amount of food consumed, does not alter usual dietary practices, and is likely to be safer than administration of sweet liquid vitamin-mineral preparations that can lead to accidental overdose. In linear programming analyses (Dewey et al., 2004), when fortified products, such as Corn-Soy Blend, Nutributter (a fat-based spread), Sprinkles (Zlotkin et al., 2003), or a crushable micronutrient tablet were included in the diet, there was no need for commercial infant formula, and non-milk animal source foods were optional. Furthermore, the amount of milk needed was generally less than when fortified products were not included. Without any milk in the diet, calcium needs may not be completely met (because some of the fortified products include little or no calcium), and the product would need to include vitamin B-12 if there are no other animal source foods in the diet. The products used for home fortification are still undergoing research evaluation and most of them are not yet widely available. Local assessment of the nutrient shortfalls for a particular population (based on the types of foods consumed) is recommended to evaluate whether single or multiple-micronutrient fortification or supplementation is most appropriate, and the products that would be most acceptable and cost-effective.



FLUID NEEDS

A. Guideline: Non-breastfed infants and young children need at least 400-600 mL/d of extra fluids (in addition to the 200-700 mL/d of water that is estimated to come from milk and other foods) in a temperate climate, and 800-1200 mL/d in a hot climate. Plain, clean (boiled, if necessary) water should be offered several times per day to ensure that the infant's thirst is satisfied.

B. Scientific rationale: Because breast milk is almost 90% water, infants and young children who are breastfed frequently generally receive plenty of fluids. However, non-breastfed children need to obtain fluids from other sources. The total amount of water needed per day depends on the child's urinary and non-urinary water losses. Urinary water losses are a function of the renal solute load (solutes that must be excreted by the kidney) and the child's renal concentrating ability (concentration of urine), both expressed as milli-osmoles (mosm) of solutes per litre of solution. Renal solute load is made up of the non-metabolizable components of the diet, primarily the electrolytes that are consumed in amounts that exceed body needs (sodium, chloride, potassium and phosphorus) and the nitrogenous end products resulting from protein digestion and metabolism. Thus, the amount of solutes to be excreted, and the amount of fluid required, depends on the composition of the diet. Diets that are high in electrolytes and/or protein will increase the amount of fluid required.

The diets generated by the linear programming analyses described above (Dewey et al., 2004) were used to estimate fluid needs of non-breastfed children. For each diet, the potential renal solute load was calculated to predict urinary water losses. The renal concentrating ability of an infant at ~ nine months of age is estimated to be 1100 mosm/L (Fomon, 1993), but to allow for a margin of safety, a value of 700 mosm/L was used in these calculations. Non-urinary water losses were estimated based on body weight. After estimating the total fluid needs for each diet (700-1200 mL/d), the amount of water in the foods themselves (including milk) was subtracted from the total to yield the net additional water required, 400-600 mL/d of extra fluids (in addition to the 200-700 mL/d of water that is estimated to come from milk and other foods). Under hot conditions, non-urinary water losses increase. Assuming that the losses are doubled under tropical conditions, the estimated amount of extra fluid needed would be 800-1200 mL/d. This water can be incorporated into porridges or other foods, but plain, clean (boiled, if necessary) water is less likely to support bacterial growth if accidentally contaminated and should be offered frequently to ensure that the child is receiving enough fluid.

Plain, clean water should be offered several times a day to meet fluid needs.

six

seven

SAFE PREPARATION AND STORAGE OF FOODS

A. Guideline: Practise good hygiene and proper food handling by a) washing caregivers' and children's hands with soap (or a rubbing agent such as ash) before food preparation and eating, b) storing foods safely and serving foods immediately after preparation, c) using clean utensils to prepare and serve food, d) using clean cups and bowls when feeding children, and e) avoiding the use of feeding bottles, which are difficult to keep clean.

B. Scientific rationale: Attention to hygienic practices during food preparation and feeding is critical for prevention of gastrointestinal illness. The peak incidence of diarrhoeal disease is during the second half year of infancy (Bern et al., 1992). Microbial contamination of foods is a major cause of childhood diarrhoea, and can be prevented by adequate hygienic practices. The Five Keys to Safer Food include 1) keep hands, food preparation surfaces and equipment clean, 2) separate raw meat, poultry and seafood from other foods and use separate utensils and cutting boards for their preparation, 3) cook foods thoroughly, especially meat, poultry, eggs and seafood, 4) keep food at safe temperatures, and 5) use safe water and raw materials (for additional details, see WHO, 2000 and Five Keys to Safer Food http://www.who.int/foodsafety/publications/consumer/5keys/en/). Because they are difficult to keep clean, feeding bottles are a particularly important route of transmission of pathogens. In peri-urban Peru, 35% of bottle teats tested positive for *E. coli*, an indicator of fecal contamination, and 31% of teas served in baby bottles were contaminated with *E. coli* compared with only 2% of teas served in cups (Black et al., 1989).

Attention to hygienic practices during food preparation and feeding is critical for prevention of diarrhoea.

Although there are significant barriers to compliance with the above recommendations in many settings (including lack of safe water and facilities for safe preparation and storage of food, and time constraints for the caregivers), carefully planned educational interventions can result in substantial improvement (Monte et al., 1997). In addition, use of fermented foods can reduce the risk of microbial contamination (Kimmons et al., 1999) and may have the added advantage of improving nutrient content (WHO/UNICEF, 1998).

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RESPONSIVE FEEDING

A. Guideline: Practise responsive feeding, applying the principles of psycho-social care. Specifically: a) feed infants directly and assist older children when they feed themselves, being sensitive to their hunger and satiety cues; b) feed slowly and patiently, and encourage children to eat, but do not force them; c) if children refuse many foods, experiment with different food combinations, tastes, textures and methods of encouragement; e) minimize distractions during meals if the child loses interest easily; f) remember that feeding times are periods of learning and love - talk to children during feeding, with eye to eye contact.

B. Scientific rationale: There is increasing recognition that optimal infant feeding depends not only on *what* is fed, but also on *how*, *when*, *where*, and *by whom* the child is fed (Pelto et al., 2002). Behavioural studies have revealed that a "laissez-faire" style of feeding predominates in some populations (Engle and Zeitlin, 1996; Bentley et al., 1991; Bentley et al., 1992), with encouragement to eat rarely observed, or observed only when children refused food or were ill. It has been hypothesized that a more active style of feeding may improve dietary intake. The evidence to date on the impact of feeding behaviours on dietary intake and child health is sparse, however (Engle et al., 2000). In an urban population in Ghana, Ruel et al. (1999) found that a "care practices" scale (which included breastfeeding patterns, timing of complementary feeding, food quality, and two "active feeding" behaviours) was positively associated with child anthropometric status among mothers with little or no schooling. Several intervention studies that included feeding behaviours as part of the recommended practices have reported positive effects on child growth (Sternin et al., 1997; Penny et al., 2005), but it is not possible to separate the influence of responsive feeding from that of the other changes that occurred in breastfeeding practices and the types of foods offered. When more data are available from controlled research trials, it may be possible to pinpoint the types of feeding behaviours that make the most difference to child health and behavioural development. In the meantime, the recommendations above represent the current consensus on optimal practices among experts in the field.

Optimal infant feeding depends not only on what is fed, but also on how, when, where and by whom the child is fed.

nine

FEEDING DURING AND AFTER ILLNESS

A. Guideline: Increase fluid intake during illness and encourage the child to eat soft, varied, appetizing, favourite foods. After illness, give food more often than usual and encourage the child to eat more.

B. Scientific rationale: During illness, the need for fluids is often higher than normal. For example, non-urinary water losses during diarrhoea can be 2-3 times greater than usual. Fever can also increase water losses. In such circumstances, it is essential that extra fluids be provided in addition to the water that would be coming from the normal diet. If a non-breastfed child refuses the quantity of water needed, it may be necessary to restrict the intake of foods that are high in potential renal solute load during illness, such as fish, cheese, chicken, beef and liver. Even though appetite may be reduced during illness, continued consumption of foods is recommended to maintain nutrient intake and enhance recovery (Brown, 2001). After illness, the child needs greater nutrient intake to make up for nutrient losses during the illness and allow for catch-up growth. Extra food is needed until the child has regained any weight lost and is growing well again.

Children need more fluids and continued feeding during illness. Extra food will be needed after illness until the child is growing well again.



USE OF THE GUIDING PRINCIPLES

The current scientific evidence for feeding non-breastfed children is summarized in these Guiding Principles. The length of the scientific rationale for each guideline varies considerably, because of differences in the knowledge base and complexity of the recommendation. Research is needed on a number of topics to improve this knowledge base as well as to provide information on how to translate this knowledge into effective policies and programmes in different settings. However, given the importance of infant and young child nutrition for adequate physical and cognitive development and the critical window of opportunity during the first two years of life to ensure a healthy start to life, the available knowledge base was considered sufficiently robust to develop this set of guidelines.

The implementation of these Guiding Principles may require additional local research.

The Guiding Principles are intended to guide policy and programmatic action at global, national, and community levels. Their implementation will require additional research in most settings to identify culturally acceptable and affordable foods that can be promoted in meal preparation and as snacks, identify factors that facilitate or are barriers to adopting improved feeding behaviours by caregivers and families, and translate each guideline into specific messages that are understood by health care providers, mothers and other caregivers. Annex 1 summarizes steps to translate these guiding principles into locally adapted feeding guidelines that are adequate and feasible for implementation by caregivers. Annex 2 summarizes key issues around early breastfeeding cessation for non-breastfed infants and young children of HIV-positive mothers. This section pays special attention to timing, care and making a safe transition.

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TABLES AND ANNEXES

table one

Table 1. Quantities of foods in sample regional diets[1] that meet estimated energy needs[2], by age interval

	Quantities (g/day)								
	6-8 months			9-11 months			12-23 months		
Foods	Diet 1	Diet 2	Diet 3	Diet 1	Diet 2	Diet 3	Diet 1	Diet 2	Diet 3
Latin America									
Milk	200-240	250-370	400-500	200-360	200-360	375-515	200-230	280-310	420-440
Cheese	0	20	20	0-20	20	20	0-20	0-20	15-20
Egg	50	50	-	50	50	-	0-50	50	-
Meat, poultry, fish or liver	35-75	-	-	35-75	-	-	25-90	-	-
Tortilla, bread or rice	30-60	30	30	30-70	30	30-50	30-75	30	30
Beans	55-80	70-80	60-80	80	80	80	80	80	80
Plantain or sweet potato	0-25	0	0	0-90	0-100	0-65	0-180	180	130-180
Spinach	40	40	40	40	40	40	40	40	40
Avocado	0-25	0-30	0-20	0-30	30	0-30	0-30	30	30
Carrot	85	85	85	85	85	85	0-85	85	85
Papaya	15-35	30	30	15-35	0-20	0-10	0-35	0	0

1 All values are for prepared foods (cooked, as appropriate). Diet 1 includes dairy products, egg and other animal-source foods, Diet 2 includes dairy products and egg but no other animal-source foods, and Diet 3 includes dairy products but no other animal-source foods. Source: Dewey et al., 2004.

2 Diets that do not contain animal-source foods (meat, poultry, fish or eggs, plus milk products) cannot meet all nutrient needs at this age unless fortified products or nutrient supplements are used.

	Quantities (g/day)								
	6-8 months			9-11 months			12-23 months		
Foods	Diet 1	Diet 2	Diet 3	Diet 1	Diet 2	Diet 3	Diet 1	Diet 2	Diet 3
West Africa									
Milk	200	350	490	200	340	480	340-350	340	340
Egg	0-50	50	-	10-50	50	-	0	0	-
Meat, poultry, fish, or liver	30-75	-	-	30-75	-	-	0-15	-	-
Maize/millet porridge	60-130	95	90	90-160	115	110	70-185	185	185
Cowpeas/soybeans	100	100	100	100	100	100	100	100	100
Groundnut soup	0-40	0	0	0-50	0	40	90-100	90	90
Taro leaf	40	40	40	40	40	0	0-40	40	40
Tomato	65	65	65	65	65	65	0	0	0
Orange juice	0	0	0	0	0	0	15-35	15	15
Oil	0-5	0	0	0-5	5	5	0	0	0
									3
South Asia									
Milk	200	200	340	200	200	340	270-350	310	75
Egg	50	50	-	50	50	-	20-50	50	-
Meat, poultry, fish, or liver	35-70	-	-	35-75	-	-	20-75	-	-
Rice or wheat	0-30	0-30	0-30	0-30	0-30	0-30	0-70	20-40	20-70
Lentils	80	80	80	80	80	80	80	80	80
Potato	70-125	125	125	125	125	125	125	125	125
Spinach	40	40	40	40	40	40	40	40	40
Pumpkin	130	130	130	130	130	130	130	0-130	130
Onion	0	20	20	0-10	20	20	20	0-20	20
Guava	0	25	25	25	25	25	25	0-25	25
Oil	0-5	5	5	0-5	5	5	0-5	5	5

table two

Table 2. Energy requirements, minimum meal frequency and minimum dietary energy density for non-breastfed children 6-24 months of age

Age	6-8 months	9-11 months	12-23 months
Average energy requirement (kcal/d)	615	686	894
Energy requirement + 2 SD (+ 25%)	769	858	1118
Functional gastric capacity (g/meal), based on 30 g/kg body weight	249	285	345
Number of meals required if energy density is:			
0.6 kcal/g	5.1	5.0	5.4
0.8 kcal/g	3.9	3.8	4.1
1.0 kcal/g	3.1	3.0	3.2
Minimum energy density (kcal/g) required if meal frequency is:			
3	1.03	1.00	1.08
4	0.77	0.75	0.81
5	0.62	0.60	0.65

Source: Dewey et al., 2004

annex one

ANNEX 1

Developing locally appropriate feeding recommendations based on these Guiding Principles

The *Guiding Principles for Feeding Non-breastfed Children* set standards for developing locally appropriate feeding recommendations for young children who are not breastfed and aged six months and beyond. They provide guidance on desired feeding behaviours as well as amount, consistency, frequency, energy density, and nutrient content of foods.

Feeding recommendations based on these guidelines should be feasible for implementation in households. They should be culturally appropriate so that caregivers can accept them, and they should be affordable, including in resource-poor settings.

This Annex provides basic guidance on a formative research process that programme managers, researchers, and policy-makers can follow to translate these *Guiding Principles* into concrete local feeding recommendations that mothers and other caregivers can understand and use. It summarizes a logical sequence of steps and refers at the end to several guides for further information on how to conduct the process.

Step 1 - Review available information

In many countries, there are national policies and guidelines that include feeding recommendations for infants and young children who are breastfed. Results of formative research may be available that describe local feeding practices, major constraints associated with them, and options for improving the diets of young children. Specific information on feeding options for infants and young children who are not breastfed is less likely to be available. Reviewing available information is a first step that will help to guide and streamline the formative research that may be needed and identify the necessary next steps. Information to be reviewed includes:

- **Epidemiological information:** socio-demographic data such as income, infant and child mortality rates, rural/urban residence, prevalence of common childhood illnesses, access to safe water and sanitation.

- **Nutritional information:** prevalence and patterns of malnutrition, complementary feeding practices, commonly available foods, prices and seasonal fluctuations; attitudes, beliefs and cultural practices for infant and young child feeding.

- **Infant feeding and nutrition policies and guidelines:** with special attention to policies for complementary feeding of breastfed children, micro-nutrient supplementation and fortification, prevention of HIV transmission and care for HIV-infected children.

- **The status of existing programmes** that address infant feeding practices and their key messages, e.g. Integrated Management of Childhood Illness, Nutrition, HIV/AIDS (prevention and care), and community development.
- **The experiences of NGOs and other groups** that might be working on infant feeding - including prevention of mother-to-child transmission of HIV, home-based management of malnutrition, and nutritional support for displaced people.

Step 2 - Formulate the research questions

The information gathered in Step 1 may not be sufficient to develop adequate feeding recommendations for non-breastfed children or to identify appropriate ways for their promotion. Questions may relate to:

- whether possible feeding options are acceptable, feasible, affordable and safe?
- what are major constraints and facilitating factors for each feeding option?
- what training, information, education and communication support and other resources will be needed to ensure that infant feeding counselling takes place in communities, including counselling on replacement feeding for HIV-positive mothers?

Step 3 - Identify study sites

Formative research, if needed, should be carried out in a population or population groups that are representative of the areas where counselling on infant feeding for non-breastfed children will take place. Where early cessation of exclusive breastfeeding is practised as part of prevention of MTCT of HIV, it is useful to select sites that already have in place HIV testing and counselling and related support services.

Step 4 - Identify informants

It is important to obtain information from a range of different informants who play a role in setting norms, providing advice and support, and influencing child-rearing behaviours. Key informants for formative research on feeding practices for non-breastfed children include:

- Mothers of young children (<18 months)
- Fathers of young children (<18 months)
- Health providers
- Community leaders
- Elder family members

Step 5 - Choose research methods

There is no blueprint for selecting the combination of methods to be used. The selection should be based on available information and gaps to be filled by the research. The following guidance is given as an aid to selecting appropriate research methods:

- **In-depth interviews** are useful for obtaining information on private issues, on actual feeding behaviours, and on reasons for them.
- **Focus group discussions** are useful for obtaining information on norms, attitudes and beliefs. They can also be used to obtain information on sensitive topics. For example, grandmothers may more readily share their opinions on early cessation of breastfeeding in the context of a group discussion rather than individually.
- **Structured or semi-structured observations** are useful for obtaining information on the physical environment, water sources and quality, food/milk/formula preparation and safety, and household food availability.
- **Market surveys** are needed to determine the costs, distribution, and availability of ingredients and commodities required by different feeding recommendations.
- **Dietary assessments** of feeding patterns are recommended if food intake data are not available. Often national feeding recommendations already exist for breastfed children, for example, based on work done to adapt the Integrated Management of Childhood Illness (IMCI) food box. If this is the case, then a simple dietary history or modified 24-hour recall can provide sufficient information for determining feeding recommendations.
- **Trials of new practices** can be carried out to make informed decisions about the likelihood that draft feeding recommendations based on the information gathered will be adopted and consistently practised in a safe and appropriate manner. Linear programming techniques may be especially useful to assess the adequacy and costs of different alternatives. The draft recommendations are discussed with caregivers who will try out foods and methods and report on their experiences after an interval (some days to one week)

Step 6 - Determine study sample and sample size

Purposive sampling is appropriate, allowing for a minimum sample in each population group to obtain reliable information. A minimum sample typically involves 15 applications of various research methods described above, e.g, 15 in-depth interviews or 15 trials of new practices. The sample size can be increased if the information emerging does not show a clear pattern.

Step 7 - Develop, test and translate study forms

All forms should be available in the local language and they should be pre-tested prior to the start of the study. Pre-testing involves administration or use of each form among 3-4 different respondents to check for interview flow, question clarity, and missing or unclear information.

Step 8 - Recruit and train field investigators

Ideally, field investigators will have previous qualitative research experience as well as background in nutrition and possibly HIV/AIDS counselling. A multi-disciplinary team is recommended. The initial training should be followed by continuous supervision and feedback during the formative research to ensure the quality of data and to correct any study gaps or problems during study implementation.

Steps 9 and 10 - Conduct formative research and analyse results

Analysis of qualitative findings is an iterative process that begins in the field and continues throughout the research. During field work, notes from observations, group discussions and interviews will be regularly reviewed to ensure that answers are complete and clearly reported. If findings are very different, determine why. In some cases, investigators may wish to add questions if new topics emerge during field work.

Step 11 - Finalize feeding recommendations

Based on the results of formative research, formulate or finalize feeding recommendations that are acceptable, feasible, affordable, sustainable and safe (AFASS). Table 1 on page 30 lists criteria for assessing feeding options.

Step 12 - Disseminate findings

In addition to preparing a full report, it is important to present the findings of the research to stakeholders and decision-makers, in order for them to understand the background of the updated feeding recommendations and gain acceptance for integration in relevant guidelines and programmes.

Steps 13 - Integrate feeding recommendations into existing guidelines

Counselling on infant and young child feeding should be integrated into services for newborn and child care. Entry points for counselling on feeding non-breastfed infants after six months of age include immunization, well-baby clinic, family planning, HIV care and sick child visits. IMCI is a strategy that promotes combined delivery of curative and preventive care including infant feeding.

Counselling mothers and caregivers of non-breastfed children may take place in settings where continued breastfeeding with appropriate complementary foods remains the optimal feeding option for the majority of children that attend the services. Privacy and confidentiality are therefore essential conditions to avoid a spill-over of recommendations to the general population of children.

Practical guides for use in formative research on feeding options

WHO/UNICEF. *What are the options? Using formative research to adapt global recommendations on HIV and infant feeding to the local context*, World Health Organization, Department of Child and Adolescent Health and Development, Geneva 2004. http://www.who.int/child-adolescent-health/publications/NUTRITION/ISBN_92_4_159136_6.htm

WHO. *IMCI Adaptation Guide. Part 3 Study protocols.* World Health Organization, Department of Child and Adolescent Health and Development, Geneva 2002. http://www.who.int/child-adolescent-health/publications/IMCI/WHO_CHD_99.htm

Designing by Dialogue. A programme planners guide to consultative research for improving young child feeding. Support for Analysis and Research in Africa, Academy for Educational Development, Washington 1997. sara@aed.org

Linear programming module of NutriSurvey. http://www.nutrisurvey.de/lp/lp.htm

annex two

ANNEX 2

Key issues around early breastfeeding cessation for non-breastfed infants and young children of HIV-positive mothers: Timing, safe transition and care

Background

Among the infants who will not enjoy the benefits of breastfeeding, or will stop breastfeeding early, are the infants of mothers who are HIV-positive. This annex summarizes relevant care issues discussed in the course of developing the Guiding Principles for feeding non-breastfed children.

Mothers living with HIV may themselves suffer from ill health and deteriorating socio-economic conditions in addition to facing the challenge of feeding their young children adequately. Children born to HIV-positive women are a vulnerable risk group, in part because of their early exposure to HIV and possible infection, as well as because of the possible effects of HIV on their mothers' health and caring practices, and the economic and social impact of HIV infection on the family. This heightened vulnerability and the possible constraints on nutrition, health, and caring practices should not be overlooked in counselling and HIV care programmes.

Timing of early breastfeeding cessation by HIV-positive mothers

The risk of HIV transmission during breastfeeding continues for as long as breastfeeding is practiced. The best available estimates suggest that the rate of HIV transmission is about 8.9 HIV infections per 100 child years of any breastfeeding.

On the other hand, the risks of mortality from not breastfeeding vary from setting to setting and are greater in settings with high infant mortality. Furthermore, it is well established that malnutrition is an underlying cause of child mortality and a leading cause of illness and disability worldwide.

These issues, and the balance of risks, need to be addressed in counselling individual women about stopping breastfeeding early.

The optimal timing of breastfeeding cessation for an infant exposed to HIV varies depending on the health of the mother, the health of the infant and the risks associated with not breastfeeding. HIV-positive mothers who choose to breastfeed should discontinue it as soon as replacement feeding is affordable, feasible, acceptable, sustainable and safe (AFASS) for themselves and their babies, given local circumstances, their personal situation and the risks of replacement feeding for the infant's age. The risks and challenges of early breastfeeding cessation are greater when the infant is younger, especially less than six

months of age, but no evidence indicates a specific age for breastfeeding cessation by all HIV-positive mothers, and no blanket recommendation should be specified for all mothers in national policies and guidelines.

Considerations for feeding HIV-exposed non-breastfed children after six months

Early breastfeeding cessation may lead to poor caring practices and neglect, and to malnutrition. Some of the risks associated with early breastfeeding cessation include mastitis and breast abscesses in the mother; distress, restlessness, loss of appetite and diarrhoea in the infant; and family and community objections. To prevent or mitigate these risks, counselling and support to prepare for early breastfeeding cessation is needed.

Breast milk typically makes a significant contribution to infant nutrition well beyond six months of age. The importance of good nutrition for non-breastfeeding infants needs to be stressed in counselling about and following early breastfeeding cessation. Where economic constraints are a major factor in infant feeding decision-making, programmes for HIV-positive women should consider providing women with appropriate replacement foods to safely feed non-breastfed infants after six months. The characteristics of appropriate replacement foods are described in the Guiding Principles for Feeding Non-breastfed Children after six months.

Recommendations for making a safe transition

Mothers and caregivers require counselling and support to prepare for early cessation and to make the transition safe. Experience to date indicates that mothers can stop breastfeeding in a period of 2–3 days to 2–3 weeks with adequate counselling and support. Making a safe transition depends on preparation and skills, as well as the availability of a nutritionally adequate diet as an alternative to breastfeeding.

Based on field experience and expert consensus, the skills required for a safe transition include: how to cup-feed young infants; techniques for expressing breast milk; techniques for heat-treating breast milk if mothers decide to give expressed milk during the transition; and how to safely prepare and feed replacement foods after breastfeeding ends. In addition to these specific skills, mothers need to be prepared to deal with some of the practical and social challenges they will encounter, such as managing night feeds, finding alternative means to comfort the fretful and crying child, and dealing with social pressures to breastfeed from family, neighbours, and the community. Mothers should also be advised on the availability of health and other community services for themselves and their infants in the event that problems arise.

Recommendations for care of non-breastfed children

Care, including responsive feeding and psycho-social stimulation, should be maintained after breastfeeding ends. The guiding principle related to responsive feeding is especially relevant:

- "Practice responsive feeding, applying the principles of psycho-social care:
  - feed infants directly and assist older children when they feed themselves, being sensitive to their hunger and satiety cues;
  - feed slowly and patiently, and encourage children to eat, but do not force them;
  - if children refuse many foods, experiment with different food combinations, tastes, textures and methods of encouragement;
  - minimize distractions during meals if the child loses interest easily;
  - remember that feeding times are periods of learning and love - talk to children during feeding, with eye to eye contact."

Unresolved issues and knowledge gaps

It is important to stress that the impact of early breastfeeding cessation on infant and young child nutrition, health and survival, in programmatic settings, is not yet known. Further research is needed to enhance our knowledge of some of the key elements of the recommendation for HIV-positive mothers to stop breastfeeding early and their impact. Priority issues include the need for low-cost means for early testing of HIV-exposed infants so that infant feeding decisions such as early breastfeeding cessation can be made with knowledge of infant HIV-status; low-cost tools to identify women at greatest and least risk of HIV transmission during breastfeeding to improve the individualized counselling messages about transmission risk; additional data on the mortality risks to HIV-exposed infants who are not breastfed in rural and urban areas; information on locally available foods that are nutritionally adequate and suitable for feeding non-breastfed infants after early cessation; and further research on strategies that are most effective for training health workers and supporting mothers to promote and achieve the safe transition to early breastfeeding cessation and safe replacement feeding after breastfeeding ends.